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TITLE: Method and system for communications connectivity failure diagnosis

Abstract Text (1):

A system and method is disclosed for communications connectivity failure diagnosis that includes receiving a connectivity failure notice at an on-line center indicative of a communications failure between the on-line center and an in-field product, such as a medical diagnostic device. A software-based non-connect test is manually initiated to confirm a communications failure between the on-line center and the in-field product. Once the communications failure is confirmed, the communications failure is diagnosed by isolating the communications failure through use of the non-connect test and identifying a failure type which indicates what portion of the system failed. The method includes reporting the communications failure for repair, and once repaired, the system conducts a series of tests to confirm proper connectivity and logs the results therefrom. Optionally, the system includes an entitlement check which automatically ensures that a particular customer, or in-field product, is entitled, or under contract, for the diagnostic service. Also, if the fault is not found timely, there are provisions in which the service is escalated to increased levels of support to ensure customer satisfaction.

Brief Summary Text (7):

Improvements in computer networks have greatly facilitated the task of offering assistance to medical imaging equipment. In particular, rather than having to call a service center and talk to a technician or engineer, or to await a return call from the service center, network technologies have facilitated proactive techniques wherein the service center may contact the medical diagnostic equipment to check the status of subscribing equipment. Further advancements have been proposed to provide remote service to medical diagnostic systems in an effort to provide the level of service on a continual and interactive basis as needed by many facilities. In one such system, a service center can interactively receive messages via a network and can respond automatically to the messages if configured correctly. Data required to analyze the state of operation of the medical diagnostic equipment can be transferred during an electronic connection. This technique greatly facilitates identification of system problems, allows questions to be posed to the subscribing service provider, facilitates transfer of updates and imaging protocols, and permits standard and customized reports to be transmitted to subscribing systems or stations. The interactive aspect of this technique allows the medical diagnostic facility to remain current on services provided by the centralized service facility and to readily communicate with the centralized service facility.

Detailed Description Text (4):

In general, a customer site may have a number of in-field products. A subscribing station may include a variety of medical diagnostic systems of various modalities. As an example, in the present embodiment, the in-field products may include a number of networked medical image scanners 26 connected to an internal network 24 served by a single scanner 28 having a work station configured to also act as a server, or configured as a stand-alone server without a medical image scanner associated therewith. Alternately, a subscribing station, or customer site 14 can

include a number of non-networked medical image scanners, 30, 32, 34, each having a computer or work station associated therewith and having an internal modem 36, 38, 40 to connect the subscribing station to a communications link, such as the Internet 18 through links 37, 39, and 41, respectively, to communicate with the on-line center 16. Internet 18 is shown in phantom to indicate that an external communications network can include Internet 18, together with communication links 29, 37, 39 and 41, or alternatively, can include direct dial-up links through dedicated lines, an intranet, or public communications systems.

Detailed Description Text (7):

The communication connectivity failure diagnosis process and system of the present invention can be initiated by authorized personnel, such as an on-line engineer or technician, administrative personnel, and/or other such similar authorized personnel, from a computer or workstation 42 in the remote link 20, which can be a part of the on-line center 16, or be separately connected to the on-line center 16 by a dialup link 44 to a web server 46 in the on-line center 16. Alternatively, it is contemplated that the system could be initialized by a laptop computer 22 connected to a customer internal network 24, or individually connected to each of the scanners 30, 32, or 34. The remote link 20 also can serve to connect the on-line center 16 to a subscribing station by a telephone and telephone connection 48 through a conventional telephone network 50 and to an interactive voice recognition system (IVR) 52 in the on-line center 16. The on-line center 16 includes a number of processing systems including computers for the IVR system 52, an automated support center 54, and the web server 46. Other processor systems include computers to maintain a voicemail system 58, a pager system 60, an email system 62, and a main frame 64, and more generally, an output report generator and notifier. Each is connectable and can transmit data through a network, such as an ethernet 66 with one another, or with at least one database 68. However, it is understood that the single representation of a database in FIG. 1 is for demonstrative purposes only, and it is assumed that there is a need for multiple databases in such a system. It is also understood that the IVR system is not only a voice recognition system, but can also process interactive keypad entry from a touchtone telephone 48. A bank of modems 70 is connected to the ethernet 66 to relay data from the on-line center 16 and to the subscribing stations 12, 14 through a plurality of modem links 72.

Detailed Description Text (11):

FIG. 3 shows details of the notification process outlined in FIG. 2. After initialization 80, notification 82 is provided by either a call from the customer 102 or a call from a field engineer 104. Typically the call will originate at one of the subscribing stations and is received by an on-line engineer 106 at the on-line center. Such notification is generically referred to as a non-computerized connectivity failure notice, and that indication of a communications failure is then input to the computerized system in the on-line center by the on-line engineer at 106. Alternatively, a communications failure may also be provided by a computerized automatic connectivity failure notice 108 which is then logged in a database 110. The computerized automatic connectivity failure notice can be provided by a scheduled automated non-connect test which is conducted periodically between the on-line center and each subscribing station by a computer in the on-line center 16 of FIG. 1. Once the on-line engineer enters the communications failure notification into the computer 106, FIG. 2, or the data is logged automatically 110, the system checks to see if a database case has already been opened 112, and if it has not 114, a case is opened and set in a queue 116 until an on-line engineer is available to begin diagnosis 118. If there is a pre-existing case 112, 120, the notification may have come from multiple sources or called in twice, and in that case, is already in queue for an on-line engineer to begin diagnosis at 118.

Detailed Description Text (14):

Once the system ensures that a user is entitled to communications connectivity diagnosis 128, 136, the status of a computerized database case is checked at 138.

If the case has not been flagged 140, the type of failure is determined at 142 by isolating the communications failure and identifying the failure type as either an on-line center communications failure 144, a subscribing station communications failure 146, or an external communications failure 148. To initiate the repair 86 of an external communications failure, an external fault flag is set at 150 to notify an appropriate repair service and the external repair is made at 152. If the failure is isolated as either an on-line center communications failure 144, or a subscribing station communications failure 146, either an on-line engineer makes the repair at the on-line center 154 or a field engineer makes a repair at the subscribing station site 156 after being so notified.

Detailed Description Text (17):

Referring back to FIG. 5, if the manual non-connect test subroutine fails at either of the redundant confirmations 202, 204 the system ensures that the problem is a site problem 206, 208 and the diagnosis continues at 188. However, if the communications fault is found to be not at a subscribing station site 206, 210, or if after the initial escalation 172 it was determined that the manual non-connect test indicated a fault at the on-line center 174, 212, then escalation is performed at the on-line center 214, FIG. 6.

Detailed Description Text (18):

As shown in FIG. 6, once it is determined that the case must be escalated for diagnosis at the on-line center 214, a primary support personnel is paged at 216 to diagnose the on-line center communications fault 218. If the problem is diagnosed 220, 222, the fault is repaired at 224 and the redundant manual non-connect test subroutine is called at 226 and 228. If both are successful 230, 232, the repair has been successfully accomplished and the results are logged at 130, FIG. 4, the case is closed 132 and the diagnostics process is complete at 100. However, if either of FIG. 6 non-connect tests 226, 228 fails 234, 236, the process ensures that the problem lies in the on-line center 238. If the communications fault does not lie in the on-line center 240, service will be escalated at the subscribing station site 176, FIG. 5. It is contemplated that the decision at 238 of FIG. 6 could also include a tri-state check to ensure that the problem is not in the external communications system. If it were found at fault, the system could then set the external fault flag at 150, FIG. 4, to notify for repair of the external system at 152.

Detailed Description Text (19):

If the problem is determined to still be within the on-line center 238, 242 of FIG. 6, or if the fault was not diagnosed by the primary support person 220, 244, the case is again escalated, but now to a specialized connectivity development team 246 wherein the case is escalated to a primary status until the fault is diagnosed and the problem repaired at 248. Once the fault is repaired, the redundant manual non-connect test is run 226, 228 until successful at 232, at which time the results are logged 130, FIG. 4, the case is closed 132, and the communications connectivity failure diagnosis is then complete at 100.

Detailed Description Text (22):

A database is checked to determine whether the in-field product is entitled to communications connectivity failure diagnosis to ensure an owner of the in-field product has entered into a service contract for such diagnosis service. If so entitled, a computerized database case is created and placed in a queue for retrieval by an on-line engineer. The status of the case is checked to ensure that special care is not required. If special care is required, the case is escalated to a further level of support. The further level of support can include sending an electronic page to service personnel to escalate the diagnosis, such as in cases where the reported case has not been resolved for some predetermined period of time. In diagnosing the communications failure, the present invention differentiates between on-line center communications failures, subscribing station communications failures, and external communications failures. Once repaired, the

present invention redundantly confirms communications connectivity and logs the results to ensure proper connectivity.

Detailed Description Text (25):

The computer is further programmed to ensure that the status of the communications failure diagnosis does not become non-standard, for example, past due. The computer can be programmed to set a flag if the communications failure does become past due, as determined by some predetermined period of time of standard service diagnosis. The flag is then used to escalate service diagnosis to a escalated service level. The computer of the system also includes a process of checking a database to verify that the subscribing station is entitled to communications connectivity failure diagnosis, and only performs that diagnosis for such entitled subscribing stations.

Detailed Description Text (28):

The present invention has been described in terms of the preferred embodiment, and it is recognized that equivalents, alternatives, and modifications, aside from those expressly stated, are possible and within the scope of the appending claims.